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# The role of maternal depression symptoms in psychological functioning of infants with congenital heart disease subjected to heart surgery

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**Abstract**

This article investigates the psychological and emotional functioning of infants with congenital heart disease (CHD) subjected to heart surgery and their caregivers (mothers). We analyze the role of a mother's depression and anxiety levels in the infant's psychological and emotional functioning and development. Infants aged 2-12 months with CHD undergoing cardiac surgery and their mothers were enrolled.
We have revealed a general emotional ill-being of the mothers examined. We have found a delay in psychosocial and physical development of infants with CHD subjected to heart surgery. The higher level of the mothers' depression significantly correlated with a bigger delay in the psychological development of the infants with CHD subjected to heart surgery.


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*Keywords:*infants with congenital heart decease, depression, psychological development

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## 1. Introduction

Congenital heart disease (CHD) affects 1% of newborns [1]. In some cases heart surgery in infancy is the only effective therapeutic method. The use of heart surgery has improved the outcomes for children with CHD, and increased survival rates. But still the situation of heart surgery is a major psychological stress for an infant with CHD and his family. Much attention is now being placed on the developmental and psychological outcomes of these children.

Starting from birth, babies seek out human connections. They are biologically endowed with a capacity to discriminate and respond to different stimuli. They imitate facial expressions and synchronize their own expressions, gestures, and vocalization with those performed by other people. Early attachment is an effective child-mother bond that promotes survival through the child's reliance on the adult for protection [2]. When the child cannot feel safe because the parent is unavailable or unpredictable the basic conditions that promote early mental health are severely undermined.

The life-threatening nature of heart surgery in infancy, separation and distress interfere with normal child-mother interaction [3]. A long lasting stress, the fear for her infant, lack of support and fatigue can lead to the development of depression in mothers of infants with CHD subjected to heart surgery. Depressive symptoms can impair by dulling or slowing a mother's response or by provoking irritable and intrusive responses that do not match the infant's cues. The depressed mother may withdraw or have shorter, less frequent interactions with her child, touch the child less often, and respond less sensitively to her child's signals [4]. Depressive symptoms blunt the mother's expression of joy and positive affect as well as their affective availability. Such mothers talk with their infants very slowly and less often, use flat voice tones that impair language acquisition, attentiveness, affect regulation, and arousal in the infants. Depressive symptoms also diminish a mother's game-playing with her infant. Some mothers with depressive symptoms interact with their infants in an irritable and intrusive way. Such interactions fail to foster learning and behavioral regulation [5].

Infants of depressed mothers look at their mother less often, vocalize less, and show more negative affect and less play and exploratory behavior. Because the infant-directed speech of such mothers lacks the qualities that facilitate associative learning, their infants lag in their performance of standardized language and mental development scale [6].

We made research with its primary goal to examine the psychological and emotional functioning of infants with CHD subjected to heart surgery and their caregivers (mothers). We analyzed the role of a mother's depression and anxiety levels in her infant's psychological and emotional functioning and development. Our general hypothesis was that mothers' psychological ill-being might be related to the lower rates in the psychological development of infants with CHD subjected to heart surgery.

## 2. Method

The participants of our research were 150 dyads – infants with CHD subjected to heart surgery at the Bakulev Center for cardiovascular surgery, Moscow, Russia, and their caregivers (mothers), who volunteered for the study (the study group). The mean age of the infants was 5.46±2.28 months, 46% of them were girls. All the children from the study group had severe CHD, which means that they were generally symptomatic and needed to be operated on more than once.

The control group consisted of 35 infants without somatic and mental disorders and their mothers. The mothers from the study were interviewed and asked to fill in questionnaires two days before the heart surgery and two weeks after. The Centre for Epidemiologic Studies Depression Scale (CES-D) was used to measure depression levels in the mothers. State-Trait Anxiety Inventory (STAI) was used to reveal anxiety levels in the mothers.

The level of psychological development and functioning of the infants was measured two days before the surgery by The Diagnosis of Neuro-Psychological Development of Infants (DNPDI) designed by Pantukhina G.V., Pechora K.L., Frukht E.L. [7] and The Devereux Early Childhood Assessment for Infants (DECA-I).

The Devereux Early Childhood Assessment for Infants measures two key protective factors related to resilience: Initiative and Attachment/Relationship. These protective factors can generally be thought of as social and emotional skills important to a child's well-being. Initiative means an infant's ability to use independent thought and action to meet his needs. It includes an infant's efforts to do something new, imitating others' actions, keep on trying if unsuccessful, exploring the environment, seeking attention, etc.

Attachment/Relationship means a mutual, strong, long-lasting relationship between an infant and a significant adult. It manifests itself when an infant interacts happily with the familiar adult, shows its pleasure, accepts comfort, smiles at the familiar adult, acts in a good mood, responds when spoken to, etc.

Initiative and Attachment/Relationship form protective factors that buffer children against stress and adversity.
We also used structured interview to get autobiographical data and observation to learn the natural ways of child-mother interactions.

## 3. Results and discussion

The level of depression, state and trait anxiety was significantly higher ($p<0,05$, Mann–Whitney U test) in the mothers from the study group than in those from the control group ($p<0,05$). The level of self-rated emotional comfort was significantly lower in the study group.

In the study group 18.0 % of the mothers had a high level (over 25 points by CES-D) and 28.7% had a heightened level (over 19 points by CES-D) of depression symptomatology measured two days before the surgery.
In the study group 50.0% of the mothers had a high level (over 46 points by STAI) and 18.7% had a heightened level (over 31 points by STAI) of state anxiety two days before the surgery. A correlation analysis of the relationship between depression and state anxiety levels determined significant positive correlation ($p=0,009$).
In the study group 20.7 % of the mothers had a high level (over 25 points by CES-D) and 30.7% a heightened level (over 19 points by CES-D) of depression symptomatology measured two weeks after the surgery.

In the study group 30.0% of the mothers had a high level (over 46 points by STAI) and 14.0% a heightened level (over 31 points by STAI) of state anxiety measured two weeks after the surgery. The correlation analysis of the relationship between depression and state anxiety levels before and after the surgery didn't show any significant correlation. We found that the level of depression and anxiety in mothers of infants with CHD subjected to heart surgery rose higher after the surgery in those mothers whose children had got more complications after the surgery and therefore stayed longer in the intensive care unit, separated from their mothers.
Although CES-D can show us the level of depression symptomatology but it cannot show us the "face" of mothers' depression that can differ from mother to mother. In our observations we recognised the following types of depression symptomatology in mothers of infants with CHD subjected to heart surgery.

We found that 52.0% of the mothers with depression symptomatology looked emotionless and tearless. The low or sad mood that is in the heart of depressive symptoms was not visible. They usually looked dull or intellectually impaired, they didn't respond by changing their faces to a smile or animating their speech. They didn't take out their infants from the cradle when feeding them. They denied having any emotional problems though they did look unhappy. We called such mothers "frozen".

The other group of mothers of infants with CHD subjected to heart surgery (28%) looked like they were struggling to enjoy the infant. They were unable to show joy and pride in their infant even when the psychologist noted how cute their child was. They tried to entertain the infants automatically just with shaking a rattle in front of the infant's face and couldn't enjoy the interaction. We called such mothers "trying".

Another group of mothers who seemed distracted and apologetic (12%) demonstrated their symptom by being disorganized, having lapses in their attention and being forgetful. They had gloomy thoughts about their guilt that persistently interfered with their ability to organize care for their infant. They tried to explain their behaviour in self-deprecating ways with such negative statements as "I am stupid", "I am lazy". We called such mothers "guilty".

One more group (8%) consisted of mothers who concealed their symptoms and put on a happy face. Some families disapprove of openly sharing such problems as depression. In direct contrast to their inner apathy, such

mothers become very intrusive. They interact with their infants in a highly stimulating, highly controlling but erratic manner. We called such mothers “euphoric”.

We found only few mothers in the study group who reported physical signs of depressive symptoms such as continual headaches, stomach disturbances and continual illness.

According to the results obtained by using the technique “The Diagnosis of Neuro-Psychological Development of infants” designed by Pantukhina G.V., Pechora K.L., Frukht E.L., we found statistically significant differences ($p<0,05$, Mann–Whitney U test) in the level of neuro-psychological development between the study and control groups of infants: only 24.7 % of the infants with CHD subjected to heart surgery didn’t show any delay in neuro-psychological development in contrast to 80% of the infants in the control group.

We found that 44.0 % of the infants with CHD subjected to heart surgery had a delay for one epicrisis period in neuro-psychological development against to 17.1% of the infants in the control group. We detected that 31.3% of the infants with CHD subjected to heart surgery had a delay for two epicrisis periods in their neuro-psychological development opposite to 2.9% of the infants in the control group.

Most of the children in the study group didn’t show any difficulties in visual orienteering and auditory orienteering reactions. Like those in the control group the infants with CHD subjected to heart surgery followed a moving toy with their eyes, reacted to noise, turned their head toward an audio source, fixed their eyes on a caregiver, etc. In contrast to this, the infants with CHD subjected to heart surgery showed a significantly lower level of movement development than those from the control group. It can be partly explained by the neurological deficits arising from possible reduced oxygenation of their growing fetal brain and general delay in physical development due to a direct CHD consequence.

Infants with CHD subjected to heart surgery (75.1%) showed a great delay (up to 3 epicrisis periods) in emotional, social and verbal development. The emotional reaction of an infant to the communication with its mother we called a “delight complex” normally consists of fixing its eyes on the mother’s face, smile or laughter, energetic movements of its arms and legs, vocalisation. We noticed that most of the infants from the study group displayed slack “delight complex”. Neither did they follow their mother with their eyes while she was moving around the room. Their facial expression tended to be sober and it took time and some coaxing to make them smile. They showed much tension and fear when saw a stranger especially in a medical robe, but they didn’t try to find their mother with their eyes in order to get some emotional support and defence.

The results obtained by using the technique “The Devereux Early Childhood Assessment for Infants” are presented in Table 1.

Table 1. The results obtained by using “The Devereux Early Childhood Assessment for Infants”.

| Category | Mean t-score study group | Mean t-score control group |
|---|---|---|
| Initiative | | |
| Mean | **43.3** | **54.5** |
| SD | 7.3 | 11.7 |
| Attachment | | |
| Mean | **49.1** | **55.2** |
| SD | 12.1 | 7.3 |
| Total protective factor | | |
| Mean | **44.9±9.3** | **53.2,9±9.6** |

We found statistically significant differences (p<0,05, Mann–Whitney U test) in the level of initiative, attachment and total protective factor between the study and control groups of infants.

According to the results we obtained 58.7% of the infants in the study group can be assigned to the typical level of initiative, 41.7% to the area in need of initiative development.

In the study group 56% of the infants can be assigned to the typical level of attachment, 22% to the area in need of attachment development, 22% of the infants had high points of the attachment level.

The correlation analysis of the relationship between maternal depression and the delay in the neuro-psychological development in the study group determined a significant positive correlation (p=0.049). A higher level of depressive symptoms in the mothers from the study group correlated with a bigger lag in the neuro-psychological development of infants with CHD subjected to heart surgery.

A significant positive correlation was detected between the level of depressive symptoms in mothers from the study group and the initiative level of the infants (p=0,000). A significant positive correlation was detected between the level of state anxiety in mothers from the study group and the initiative level of the infants (p=0,037). No significant correlation was detected between the level of depressive symptoms in mothers from the study group and the attachment level of the infants.

## 4. Conclusion

In our research we tried to examine the role of mothers' well-being in the development of infants with CHD subjected to heart surgery. We also sought to find lags in the psychological functioning of infants with CHD subjected to heart surgery. We revealed that some of the infants with CHD subjected to heart surgery have a delay in their neuro-psychological development and a low level of initiative. It can be partly explained by neurological deficits arising from the possible reduced oxygenation of the growing fetal brain and general delay in physical development due to a direct consequence of congenital heart disease. We showed that those mothers' depressive symptoms play a negative role in the psychological functioning of their infants with CHD subjected to heart surgery and may contribute to a delay in their infants' neuro-psychological development and low level of initiative.

Further research in this field calls for sample size expansion in order to gain more reliable information. Future researchers are also recommended to focus on a search for techniques helping to improve mothers' psychological functioning in the life-threatening situation of their infants' surgery and to upgrade the level of interactions between a mother and her infant with CHD subjected to heart surgery.

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